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US 4684768 A

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(54) Anti-trap sealing device with sensor

(57) An anti-trap sealing device comprises a sealing member 50 with a flexible sealing portion (8, 10, 12, Fig 4), a portion (4, Fig 4) for mounting the member on a vehicle body and a locating portion defining an elongate chamber (52, Fig 4) for receiving an elongate sensor member 36 which is activated on deformation of the chamber (52) owing to an object being trapped. The sensor may be removable, and may be shaped so that it is not rotatable within the chamber. The chamber may be formed of a sponge or of a solid polymeric material. The sensor member may be a conductive robber switch, a piezo-electric cable or tape, a capacitive sensor, pressure sensitive conductive rubber, or a fibre-optic sensor. The sensor and the sealing member may be formed by extrusion. The device is particularly for use in a window region of a vehicle to prevent trapping of fingers or the like.

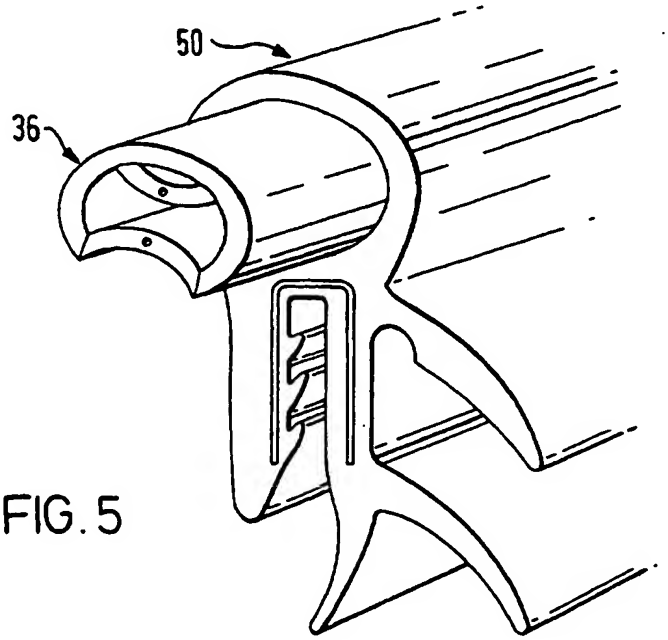

FIG. 5

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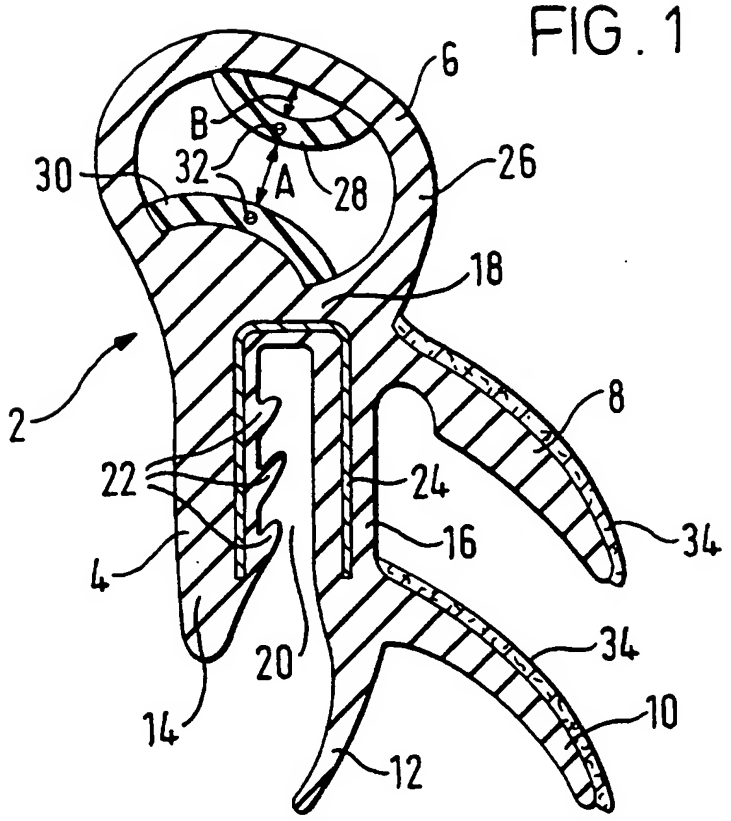
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

FIG. 1



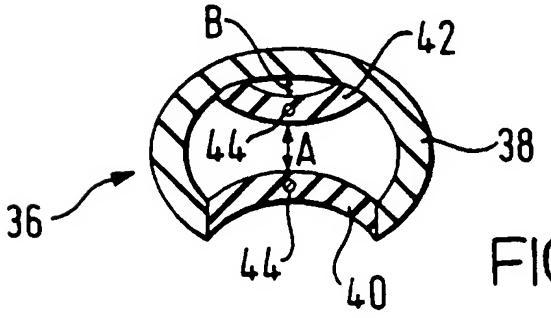


FIG. 2

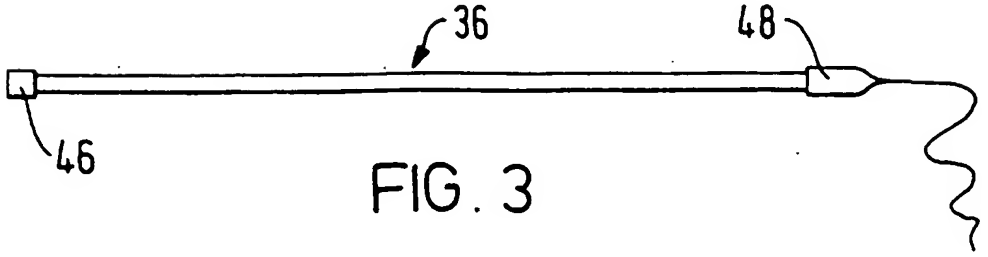


FIG. 3

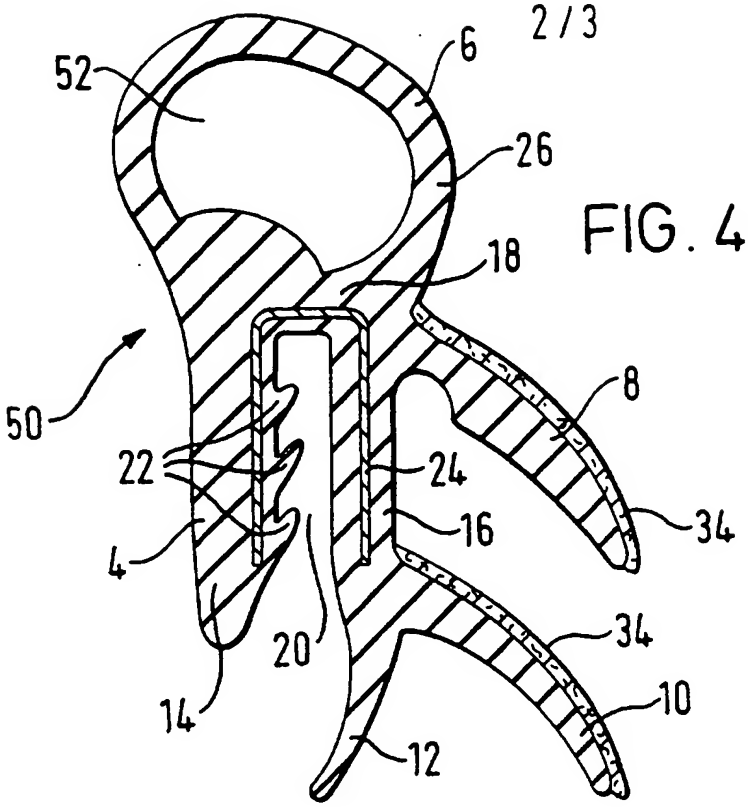


FIG. 4

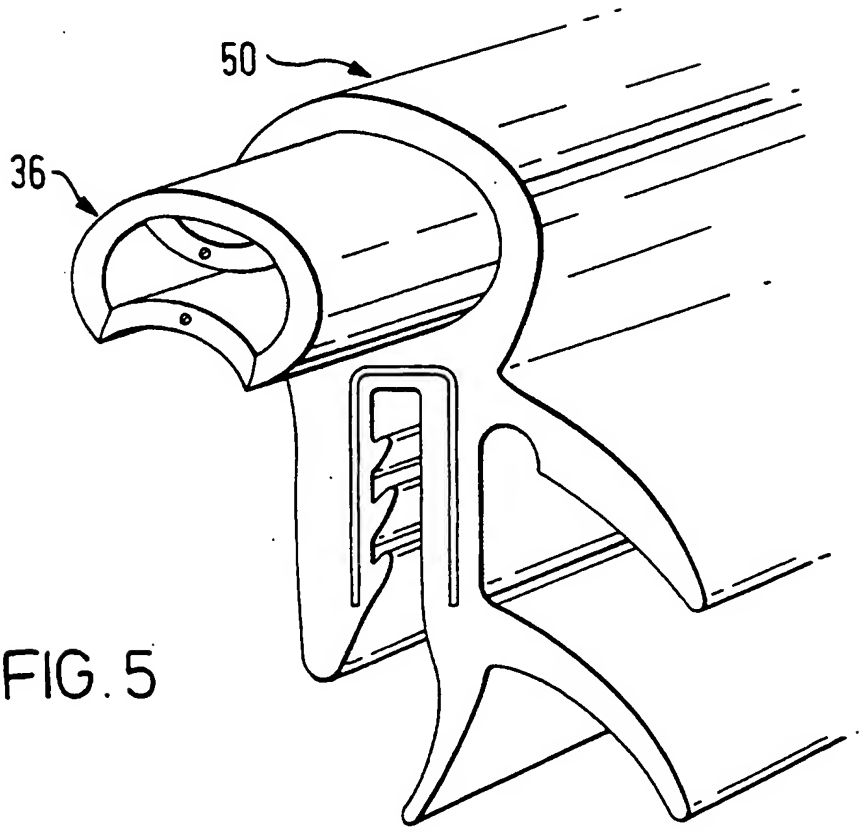


FIG. 5

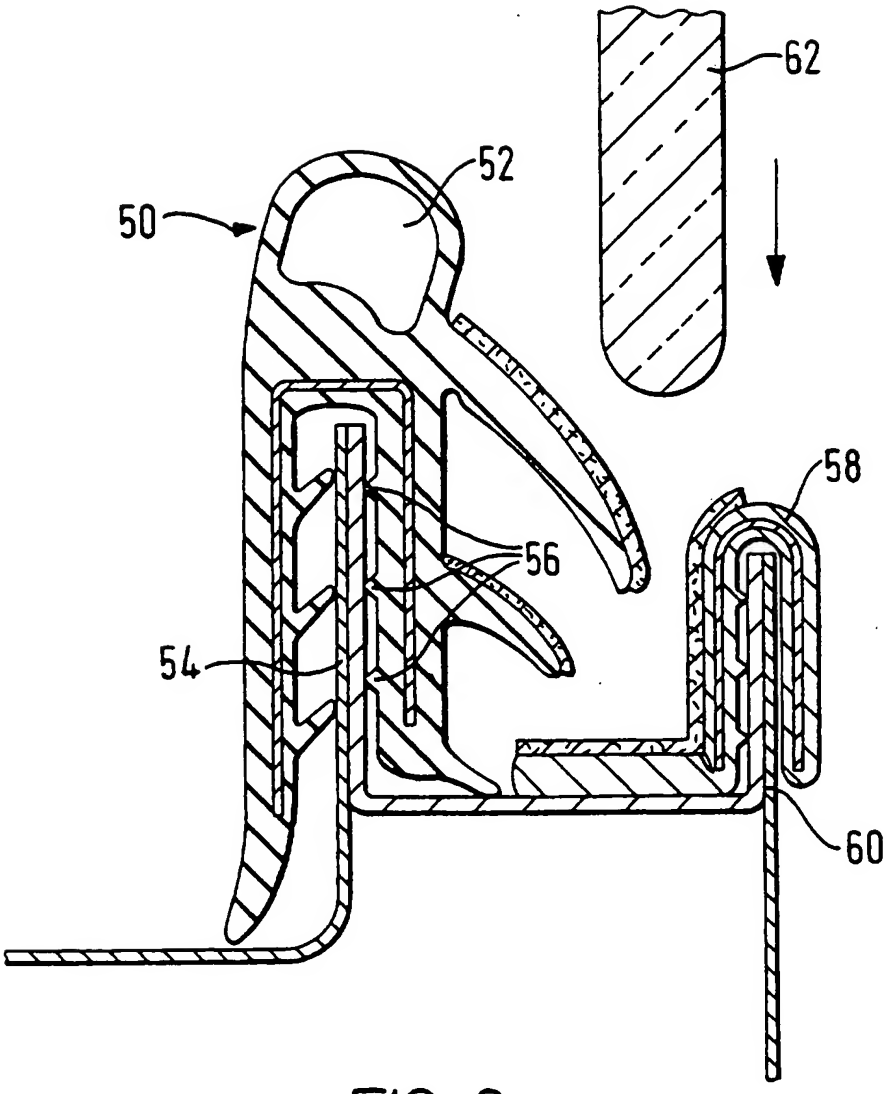


FIG. 6

ANTI-TRAP SEALING DEVICE

This invention relates to an anti-trap sealing device having an insertable/removable elongate sensor member, particularly for use in a window region of a vehicle to prevent trapping of fingers or the like against a motor-driven window pane.

Anti-trap sealing devices are known which are positioned around a window opening of a vehicle adjacent a motor-driven window pane. These anti-trap devices are activated when the window pane traps an object such as a finger between it and the sealing device. One such sealing device shown in US Patent No. 5296658 discloses two portions of conductive elastomer which are normally spaced apart but are caused to contact each other upon trapping of an object. The electrical contact is detected by external circuitry which causes the window closure to be stopped and reversed, so freeing the trapped object and preventing damage occurring. However, it has been found that during the manufacture of such a combined seal/anti-trap sensor there is a high level of scrap due to the large number of variables and materials involved in the extrusion process. Additionally, another concern is the difficulty of forming the potentially complex profile at sharp corners where the device has to be formed without being inadvertently activated but where the device must still remain reliably operable.

According to a first aspect of the present invention, there is provided an anti-trap sealing device comprising:

(a) a sealing member; and

(b) an elongate sensor member,

wherein the sealing member has a resiliently flexible sealing portion, a mounting portion for mounting the sealing member on a vehicle body portion, and a locating portion defining an elongate chamber for

receiving the sensor member substantially along its length and wherein, in use, the sensor member is activated on deformation of the chamber owing to an object being trapped against the chamber.

The device of the present invention overcomes the above-described disadvantages.

In a preferred embodiment, the sensor member is removable from the chamber. In this embodiment, if the sensor member malfunctions, it can readily be replaced, without any significant disruption to the sealing member.

Preferably, the chamber is bulbous. The chamber has, in a preferred embodiment, a continuous external surface. This provides a particularly satisfactory appearance as the surface on view is of a constant colour and gloss and also does not show any joins. In order to give extra compliance the chamber is preferably formed substantially of a sponge material. However, any other suitable material may be used, for example, a solid polymeric material.

In order to allow the sensor member to be slid into the chamber, the chamber is preferably the same general shape as, and is slightly larger than, the sensor member. In a preferred embodiment, the sensor member is shaped such that it can only be positioned in the chamber in one orientation and is not rotatable within the chamber. This is particularly important for directional sensors, for example a conductive rubber switch.

Any other suitable sensor member may be used. Examples are a conductive rubber switch, a piezo-electric cable or tape, a capacitive sensor, a pressure sensitive conductive rubber, or a fibre optic sensor. The light transmission of a fibre optic can be reduced by local bending of the fibre. If, for example, the fibre is positioned over a ribbed surface, application

of a load locally causes micro-strain bending over the ribs, reducing the light transmission which can be detected by external circuitry.

According to a second aspect of the present invention, there is provided a vehicle fitted with an anti-trap sealing device according to the first aspect of the invention, wherein the sensor member is connected to circuitry for controlling movement of a window pane. The anti-trap sealing device may also be used in other ways, for example around a sun roof opening of a vehicle.

In the manufacture of an anti-trap sealing device in accordance with the present invention, the method of manufacture comprises the steps of:

(a) forming the sealing member;

(b) separately forming the elongate sensor member; and

(c) inserting the sensor member into the chamber.

The sealing member and sensor member are preferably formed separately by extrusion and the device may be finished with the addition of end plugs and electrical connectors, as necessary, which connect the sensor device to a motor controlling the movement of a window pane or the like.

The step of forming the sealing member may, if required, comprise further finishing steps, for example moulding, trimming, or the addition of a flock or secondary coating. In particular, the sealing member may be moulded to form one or more corner portions where required by the vehicle to which it is to be fitted. This greatly simplifies the manufacture of the sealing device and improves reliability in corner regions when the sensor member has been inserted into the chamber. Once the sensor member has been inserted into the chamber, the resulting device comprising both the sealing member and the sensor member may be tested.

For a better understanding of the present invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is a cross-section through a known integral sealing member and sensor;

Figure 2 is a cross-section through one embodiment of a sensor member forming part of the sealing device according to the present invention;

Figure 3 is a side view, on a reduced scale, of the sensor member shown in Figure 2;

Figure 4 is a cross-section through one embodiment of a sealing member forming part of the sealing device according to the present invention;

Figure 5 is a perspective view showing an anti-trap sealing device according to the present invention in which the sensor member of Figure 2 is being inserted into the sealing member of Figure 4; and

Figure 6 is a cross-section of a sealing member forming part of the sealing device of the present invention positioned on a flange of a vehicle window surround.

Referring firstly to Figure 1, there is shown a known combined seal/anti-trap device generally indicated by the reference numeral 2. The device 2 comprises a relatively rigid attachment portion 4 having a resiliently flexible locating portion 6 extending therefrom. Also extending from the attachment portion 4 are lip members 8, 10 and 12 which are resiliently flexible and which, in use, perform a sealing function. The attachment portion 4 is formed from wall members 14 and 16 joined by a web 18. The walls members 14, 16 and web 18 define a channel 20 into which a flange member of a vehicle may be inserted for positioning of the device onto a vehicle, for example on a window opening surround. Additional

securement of the device onto the flange is provided by protrusions 22 extending from wall member 14 into the channel 20. Rigidity is provided to the attachment portion 4 by a metal reinforcing member 24 positioned therein. The device 2 is largely formed of an elastomeric material.

The locating portion 6 is formed of a bulb 26 which is made of an insulating elastomeric material. Positioned within the bulb 26 are opposing spaced-apart walls 28, 30 which are formed of a conductive elastomeric material. Within each of these walls is positioned a respective conductive wire 32 formed of copper.

Lip members 8 and 10 have positioned on their outer surface a flocking material 34 to reduce friction against a movable window pane when in the closed position or moving towards the closed position.

In use, the device 2 is typically positioned on a flange member in the window opening surround of a vehicle in the region of the "A" pillar and header portion. As an automatically operated window pane is raised, an object (for example a finger) may be inadvertently trapped between the window pane and the locating portion 6 thereby causing deformation of the latter and consequent contact of walls 28 and 30 due to movement of wall 30 by dimension A, which walls, upon contact, act to interrupt the power supplied to a movable window thereby preventing further movement or otherwise cause reversal of the movement of the window pane. As there will be an inevitable short delay between the switch being activated and the movement of the window pane being stopped or reversed, this overtravel is absorbed by the travel of dimension B. Whilst lip members 8 and 10 seal against a window pane when in the closed position, they may act as drip rails when they are outwardly flexed as shown in Figure 1

when the window is lowered.

Figure 2 shows one embodiment of a sensor member in the form of a conductive rubber switch which may be used as a component of the anti-trap sealing device of the present invention. The sensor member is shown generally at 36 and is formed of an insulating elastomeric wall 38 the ends of which are joined by conductive elastomeric wall 40. Extending from the interior of wall 38 is a further conductive elastomeric wall 42. Each of walls 40 and 42 have positioned therein a wire 44 which is made of copper or any other suitable conductive material.

Figure 3 shows the sensor member 36 with an end plug 46 positioned at one end thereof and an electrical connector 48 positioned at the other end thereof. The electrical connector 48 is connected to an electronic system which is connected to, and controls, the operation of a motor which operates the movable window pane. The end plug 46 may contain a resistive element or diode in order to provide the possibility of a self-check feature for the sensor and circuitry. For example, if the open resistance of the conductive rubber switch sensor 36 was greater than 100 mega ohms and closed resistance 200 ohms, then a 22 kilo ohms resistor could be used as a termination resistor. The external circuitry would normally see 22 kilo ohms when the sensor was open and 200 ohms when closed. If however one of the areas of conductive material 40, 42 and enclosed wire 40 had been cut, then the external circuitry would not see 22 kilo ohms but a much higher figure, possibly 100 mega ohms. The circuitry may then be configured to fail to safe operation either preventing the window pane closing altogether or disabling a one touch up feature.

Figure 4 shows one embodiment of a sealing member 50 which may be used as another component in the anti-

trap sealing device of the present invention. The sealing device 50 is similar to that shown in Figure 1 (but without walls 28 and 30 and wires 32) and the parts corresponding to those shown in Figure 1 are referred to by the same reference numerals. Additionally, the locating portion 6 defines a chamber 52 in which the sensor member 36 may be positioned, as shown in Figure 5. Here, the sensor member 36 is being positioned in the chamber 52 of the sealing member 50. Once in position, the sensor member 36 prevents or reverses movement of an automatically operated window pane when an object is trapped in the same way as is described above.

Figure 6 shows a sealing member similar to that in Figure 4 positioned on a flange 54 of a vehicle window surround. The sealing member also comprises further protrusions 56 for providing extra securement to the flange 54. The sealing member in the embodiment shown forms the inner part of a glass run system, the other part being formed by outer profile 58 positioned on a flange 60. A motor driven window pane 62 is movable towards a closed position in the direction shown by the arrow. In use, a sensor member would be positioned in the chamber 52, as described above and an object trapped between the closing window pane 62 and the sealing device 50 would activate the sensor member in order to prevent or reverse further closing movement of the window pane 62.

The sealing device of the present invention is particularly easy to manufacture and shape and, in a preferred embodiment, permits easy replacement of the sensor member 36 should this become necessary.

CLAIMS

1. An anti-trap sealing device comprising:

(a) a sealing member; and

(b) an elongate sensor member,

wherein the sealing member has a resiliently flexible sealing portion, a mounting portion for mounting the sealing member on a vehicle body portion, and a locating portion defining an elongate chamber for receiving the sensor member substantially along its length and wherein, in use, the sensor member is activated on deformation of the chamber owing to an object being trapped against the chamber.

2. An anti-trap sealing device according to claim 1, wherein the sensor member is removable from the chamber.

3. An anti-trap sealing device according to claim 1, wherein the chamber is bulbous.

4. An anti-trap sealing device according to any preceding claim, wherein the chamber has a continuous external surface.

5. An anti-trap sealing device according to any preceding claim, wherein the chamber is formed substantially of a sponge material.

6. An anti-trap sealing device according to any one of claims 1 to 4, wherein the chamber is formed substantially of a solid polymeric material.

7. An anti-trap sealing device according to any preceding claim, wherein the chamber is the same general shape as, and is slightly larger than, the sensor member.

8. An anti-trap sealing device according to any preceding claim, wherein the sensor member is shaped such that it can only be positioned in the chamber in one orientation and is not rotatable within the chamber.

9. An anti-trap sealing device according to any

preceding claim, wherein the sensor member is a conductive rubber switch.

10. An anti-trap sealing device according to any one of claims 1 to 8, wherein the sensor member is a piezo-electric cable or tape, a capacitive sensor, pressure sensitive conductive rubber, or a fibre optic sensor.

11. An anti-trap sealing device according to any preceding claim, wherein the sealing portion comprises one or more lip members.

12. An anti-trap sealing device substantially as hereinbefore described with reference to, and as illustrated in, Figures 2 to 6 of the accompanying drawings.

13. A vehicle fitted with an anti-trap sealing device according to any preceding claim, wherein the sensor member is connected to circuitry for controlling movement of a window pane.

14. A method of manufacture of an anti-trap sealing device in accordance with claim 1, which method comprises the steps of:

(a) forming the sealing member;

(b) separately forming the elongate sensor member; and

(c) inserting the sensor member into the chamber.

15. A method according to claim 14, wherein the sealing member and the sensor member are separately formed by extrusion.

16. A method according to claim 14 or 15, wherein the sealing member is moulded to form one or more corner portions therein.

Amendments to the claims have been filed as follows

1. An anti-trap sealing device comprising:

(a) a sealing member; and

(b) an elongate sensor member,

wherein the sealing member has a resiliently flexible sealing portion, a mounting portion for mounting the sealing member on a vehicle body portion, and a locating portion defining an elongate chamber for receiving the sensor member substantially along its length and wherein, in use, the sensor member is activated on deformation of the chamber owing to an object being trapped against the chamber, and wherein the sensor member is removable from the chamber.

2. An anti-trap sealing device according to claim 1, wherein the chamber is bulbous.

3. An anti-trap sealing device according to any preceding claim, wherein the locating portion has a continuous external surface.

4. An anti-trap sealing device according to any preceding claim, wherein the locating portion is formed substantially of a sponge material.

5. An anti-trap sealing device according to any one of claims 1 to 3, wherein the locating portion is formed substantially of a solid polymeric material.

6. An anti-trap sealing device according to any preceding claim, wherein the chamber has the same cross-sectional shape as, and is slightly larger than, the sensor member.

7. An anti-trap sealing device according to any preceding claim, wherein the sensor member is shaped such that it can only be positioned in the chamber in one orientation and is not rotatable within the chamber.

8. An anti-trap sealing device according to any preceding claim, wherein the sensor member is a conductive rubber switch.

9. An anti-trap sealing device according to any one of claims 1 to 7, wherein the sensor member is a piezo-electric cable or tape, a capacitive sensor, pressure sensitive conductive rubber, or a fibre optic sensor.

10. An anti-trap sealing device according to any preceding claim, wherein the sealing portion comprises one or more lip members.

11. An anti-trap sealing device substantially as hereinbefore described with reference to, and as illustrated in, Figures 2 to 6 of the accompanying drawings.

12. A vehicle fitted with an anti-trap sealing device according to any preceding claim, wherein the sensor member is connected to circuitry for controlling movement of a window pane.

13. A method of manufacture of an anti-trap sealing device comprising a sealing member and an elongate sensor member, wherein the sealing member has a resiliently flexible sealing portion, a mounting portion for mounting the sealing member on a vehicle body portion, and a locating portion defining an elongate chamber for receiving the sensor member substantially along its length and wherein, in use, the sensor member is activated on deformation of the chamber owing to an object being trapped against the chamber, and wherein the sensor member is removable from the chamber,

which method comprises the steps of:

(a) forming the sealing member;

(b) separately forming the elongate sensor member; and

(c) inserting the sensor member into the chamber.

14. A method according to claim 13, wherein the sealing member and the sensor member are separately formed by extrusion.

15. A method according to claim 13 or 14, wherein the sealing member is moulded to form one or more corner portions therein.

The Patent Office

13

Application No: GB 9511213.2 **Examiner:** Gill Whitfield
Claims searched: 1-16 **Date of search:** 25 July 1995

Patents Act 1977
Amended Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): E2M (MAB)

Int Cl (Ed.6): E05F (15/00, 15/20)

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 1369003 A	(PEUGEOT and RENAULT) - see especially page 2 lines 67-77; Figs	1-11, 13, 14, 16
X	EP 0381578 A1	(JAEGER) - see whole document	1, 3-11, 13-16
X	EP 0015393 A1	(SICK) - see especially page 5 line 9 - page 6 line 16, page 7 line 24 - page 8 line 16; Figs	1, 3, 4, 8-11, 13, 14
X	US 5296658 A	(KRAMER) - see whole document	1, 3-11, 13-16
X	US 4773183 A	(OKUSHIMA et al) - see especially column 5 lines 21-44; Figs 6-9	1, 3, 6, 11, 13
X	FR 2564971 A	(SAINT-GOBAIN VITRAGE) - see whole document	1, 3-7, 9-11, 13, 14
X	* US 4684768 A	(SACKMANN et al) - see especially column 4 lines 57-64; Fig 2	1 at least
	* indicates amended entry		

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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